REMARKS

This Amendment is responsive to the Office Action dated March 23, 2004. Applicants have amended claims 1, 3-13, 15-20, 22-31, 33-38, 40-50, and 52-56, and added new claims 59-68. Claims 1-68 are now pending.

Amendments

In this Amendment, Applicants have amended claims 1, 3-13, 15-20, 22-31, 33-38, 40-50, and 52-56 to more clearly present the features of the claimed invention.

Restriction Requirement

In the Office Action, the Examiner reiterated a telephonic restriction requirement with respect to claims 1-58 under 35 U.S.C. § 121 as follows:

Group I: Claims 1-56, drawn to a method and apparatus which constrains a multi-dimensional color transformation for preventing removal of selected color image data present in the source image and introduction of selected color image data not present in the source, classified in class 358, subclass 501; and

Group II: Claims 57 and 58, drawn to a method which constrains a multi-dimensional transformation for improving halftone dot integrity between first color image data and second color image data, classified in class 358, subclass 534.

During a telephonic conversation with the Examiner on March 4, 2004, Steven J. Shumaker, Applicants' representative, provisionally elected Group I with traverse. Applicants affirm this election with traverse.

Allowable Subject Matter

The Examiner objected to claims 10, 18, 29, 36, 47 and 55 as being dependent upon a rejected base claim, but indicated that such claims would be allowable if rewritten in independent form.

Claim Rejection Under 35 U.S.C. § 103

In the Office Action, the Examiner rejected claims 1-9, 11-17, 19-28, 30-35, 37-46, 48-54, and 56 under 35 U.S.C. 103(a) as being unpatentable over Stokes (USPN 5,611,030). Applicants respectfully traverse the rejection to the extent such rejections may be considered applicable to the claims as amended. Stokes fails to disclose or suggest the inventions defined by Applicants' claims, and provides no teaching that would have suggested the desirability of modification to arrive at the claimed invention.

Stokes provides no teaching that would have suggested constraining destination device coordinates produced by a multi-dimensional color transformation to prevent removal of selected color image data specified by source device coordinates, as required by amended claims 1-9, 11, 12, 20-28, 30, 38-46, 48, and 49.

In addition, Stokes fails to disclose or suggest constraining destination device coordinates produced by a multi-dimensional color transformation to prevent introduction of selected color image data not specified by source device coordinates, as set forth in amended claims 13-17, 19, 31-35, 37, 50-54 and 56.

In contrast to the claimed inventions, Stokes is directed to the problem of gamut mapping. In particular, Stokes describes a gamut mapping technique that addresses mismatches between the gamut of a destination imaging device and the gamut of a source imaging device. A destination imaging device is an imaging device used to reproduce a color image originally prepared by or for a source imaging device.

In the color science arts, the term "gamut" generally refers to the range of colors that can be produced by a given imaging device. When a destination device is incapable of producing certain colors within the gamut of a source device, a gamut mismatch results. For example, due to differences in inks, papers, and print engine technology, a first type of printer may be incapable of producing particular colors that can be readily produced on a different type of printer. Likewise, printers and other imaging devices, such as display monitors, may exhibit significant differences in the range of colors they are capable of producing.

Although different imaging devices may exhibit different gamuts, it is often desirable to reproduce the same images on those devices. In the case of color proofing, for example, a color proofer (as destination device) may be used to emulate the appearance of a color image on a

color printer or press (as source device). To be useful, a color proof generated by the destination device should approximate as closely as possible the visual appearance of a color image generated by the source device.

In the case of gamut mismatch between source and destination devices, gamut mapping must be employed. In particular, source colors that are present in a source image yet not reproducible by a destination device (out-of-gamut colors), must be mapped to destination colors within the gamut of the destination device (in-gamut colors). The gamut mapping process may result in slight, or significant, color inaccuracy, but is necessary in order to handle the reproduction of out-of-gamut colors from the source image.

The claimed inventions are not directed to gamut mapping, but rather to techniques for constraining the output of a multi-dimensional transformation to preserve selected color information specified by source device coordinates, e.g., in a source image. The claimed inventions prevent the removal of selected color image data specified by source device coordinates, or the introduction of selected color image data not specified by source device coordinates.

Application of constraints, as defined by Applicants' claims, can avoid undesirable color replacements that can result from multi-dimensional transformation. A multi-dimensional transformation typically involves transformation from a source device-dependent coordinate system (e.g., CMYK) to a device-independent color space (e.g., XYZ, L*a*b*, etc.). Then, the device-independent color space is used to produce destination device-dependent coordinates (e.g., CMYK).

There may be different combinations of destination-dependent coordinates that match the colorimetric values specified by the device-independent color space. Also, some multi-dimensional transformations may permit under color removal (UCR), gray component replacement (GCR), or other color replacement techniques. In each case, the destination device-dependent coordinates may not bear a direct relationship to the source device-dependent coordinates.

In some applications, however, it is desirable to preserve a direct relationship between selected source device destination coordinates and the destination device coordinates. In view of this objective, the claimed inventions involve application of constraints to device-dependent

coordinates produced by the multi-dimensional transformation. This approach limits the possibility of generating different sets of device-dependent coordinates that map to particular device-independent coordinates. In particular, the claimed inventions better preserve the relationship between the source device-dependent coordinates and the destination device-dependent coordinates. For example, the claimed inventions prevent removal of selected color image data specified by source device coordinates or prevent introduction of selected color image data not specified by source device coordinates.

As one example, chosen merely for purposes of illustration, the destination device coordinates used by a destination printer are produced by a multi-dimensional transformation for good colorimetric matching. However, in accordance with an embodiment of the claimed invention, the device-dependent coordinates of the destination printer are then constrained as a function of the color values specified by the source device coordinates of a source printer, e.g., to promote dot integrity.

If the source device coordinates for a given dot is black alone (C=0, M=0, Y=0, K=100), it is possible that a typical multi-dimensional transformation may nevertheless produce a colorimetric match (or numerous colorimetric matches) that includes combinations of cyan, magenta, and yellow. As a result of these conventional techniques, a dot printed with cyan, magenta, and yellow output colorants will provide a colorimetric match, but may fail to preserve the black-only dot from the source device. In this case, black is removed and/or other colorants are introduced.

This aspect of conventional multi-dimensional color transformation techniques can cause problems for press technicians in diagnosing color problems, and introduce undesirable artifacts such as misregistration not present in the black-only dot printed by the source printer. By applying the multi-dimensional transformation and constraining the destination device coordinates as a function of the corresponding source device coordinates, the claimed inventions are capable of promoting both close colorimetric matching and dot integrity.

Stokes describes a set of gamut mapping rules that govern the selection of a destination device color when a gamut mismatch occurs. In other words, Stokes provides rules for selecting a color within the gamut of a destination device when the source color is not within the destination device gamut. Hence, Stokes addresses the out-of-gamut situation. In contrast, the

claimed inventions are applicable to in-gamut situations in which a source color may be represented by a variety of different destination color combinations. The application of constraints to the destination device coordinates produced by the multi-dimensional transformation ensures that selected source color image data is preserved for use in the destination device.

Stokes makes no mention of the application of a constraint to destination device coordinates produced by a multi-dimensional transformation, as defined in Applicants' claims. Nor does Stokes discuss a desire to prevent removal of color image data specified by source device coordinates, or prevent introduction of color image data not specified by source device coordinates. Instead, Stokes describes a mapping routine for mapping an out-of-gamut color to an in-gamut color in a destination device.

In a sense, Stokes represents the antithesis of the claimed inventions. In addressing the out-of-gamut condition, Stokes actually requires removal of color image data specified by source device coordinates, or introduction of color image data not specified by source device coordinates in order to achieve gamut mapping. In other words, the selection of an in-gamut color for a color that is out-of-gamut assumes the lack of a direct match, and seems to imply that removal or introduction of unspecified color image data is therefore required.

Clearly, in the out-of-gamut condition, the destination device coordinates cannot be constrained, as claimed, because the gamut of the destination device is incapable of supporting the desired source colors in the first place. Indeed, a destination device cannot even support out-of-gamut colors colorimetrically, let alone with destination device-dependent coordinates that are constrained to avoid removal or introduction of specified color image data, as set forth in the claims.

In the Office Action, the Examiner characterized the color name matching aspect of the gamut mapping technique described by Stokes as a constraint to prevent removal or introduction of selected color image data, as claimed. Applicants respectfully disagree. The name matching feature plays no role whatsoever in the prevention of removal or introduction of selection color image data, as defined by Applicants' claims. Again, Stokes' gamut mapping technique addresses a gamut mismatch in which the device coordinates cannot support the color image data

specified by the source device coordinates, and is inherently at odds with the constraints required by Applicants' claims.

Moreover, the name matching feature merely serves to ensure that selected in-gamut colors fall in the same color category as the out-of-gamut colors when perceived by an average user. In particular, the color names associated with the in-gamut and out-of-gamut colors are based on "psychophysical experimentation" indicating what an average user is likely to call a respective color. Hence, a color name, far from designating precise color image data specified by source device coordinates, appears to refer to a range of color that satisfies the "pyschophysical" or aesthetic perception standards of an average human viewer. According to Stokes, by assigning color names, and ensuring color name agreement between out-of-gamut and in-gamut colors, a more visually pleasing result can be achieved.

In view of the differences discussed above, Applicants respectfully request reconsideration by the Examiner. Stokes fails to disclose or suggest the inventions set forth in Applicants' claims, and provides no teaching that would have suggested modification to arrive at such inventions. Therefore, Stokes does not support a prima facie case of unpatentability with respect to Applicants' claims, and the rejection under section 103 must be withdrawn. With a better understanding of the scope and content of the Stokes reference, Applicants respectfully believe the Examiner should agree.

In focusing on the requirements of the independent claims, Applicants neither admit nor acquiesce in the propriety of the rejections applied against the dependent claims. For purposes of brevity and focus, and in view of the fundamental shortcomings of the Stokes reference discussed above, Applicants have at this time withheld further comments concerning the features set forth in the dependent claims. Applicants reserve the right to further address other features of the independent or dependent claims in any future communications.

New Claims:

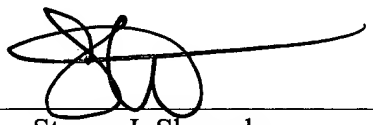
Applicants have added claims 59-68 to the pending application. Stokes fails to disclose or suggest the inventions defined by Applicants' new claims, and provide no teaching that would have suggested the desirability of modification to arrive at the claimed inventions. As one example, the Stokes reference does not suggest a method for multi-dimensional color

transformation comprising applying a multi-dimensional color transformation for transformation of source device coordinates to destination device coordinates, and constraining the destination device coordinates to a range of matching device coordinates searched by the multi-dimensional color transformation as a function of the source device coordinates. Accordingly, new claims 59-68 should be in condition for immediate allowance. No new matter has been added by the new claims.

CONCLUSION

All claims in this application are in condition for allowance. Applicants respectfully request reconsideration and prompt allowance of all pending claims. Please charge any additional fees or credit any overpayment to deposit account number 50-1778. The Examiner is invited to telephone the below-signed attorney to discuss this application.

Date: 6-23-04

By: 

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